

# **Verification Study of the WFO Monterey PoP and QPF Forecasts for the High Impact Storm Event of 4 January 2008**

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## **I. INTRODUCTION**

The storm of 4 January 2008 (Figure 1) was the most significant high-impact weather event for the CWA of WFO San Francisco/Monterey during the winter season of 2007-08. Associated impacts ranged from very strong winds and extensive areas of wind damage and power outages, to widespread heavy rains. Qualitative assessment of the historical magnitude of the event is provided by the “Bay Area Storm Index” (BASI) ranking system (<http://ggweather.com/basi.htm>) developed by Jan Null, CCM (Certified Consulting Meteorologist), which uses the 3 criteria of San Francisco City 24-hr maximum precipitation, San Francisco Airport (KSFO) maximum sustained wind, and Bay Area peak wind below 1500 ft. The resulting BASI for this storm was 9.0 (based on values of 2.01”, 53 mph and 87 mph, respectively) – only the 2<sup>nd</sup> storm of this BASI magnitude to have occurred since the emblematic BASI = 10 storm of December 1995 (the other occurring in December 2002).

This paper will examine the PoP and QPF forecast performance of WFO Monterey for this high impact event. In general across the WFO Monterey CWA (Figure 2), this was the first and largest-magnitude of only two major precipitation episodes that have occurred thus far during the 2007-08 water year. Daily precipitation data from the RAWS sites at Hawkeye, Ben Lomond and Big Sur (in the northern, central and southern portions of the CWA respectively) for the period 1 October 2007 through 10 March 2008 are shown in Figure 3. At all 3 locations the largest single daily precipitation total occurred on January 4.

## **II. POP AND QPF FORECAST VERIFICATION**

Examination and verification of WFO Monterey’s PoP and QPF forecasts for this event was performed through use of both BOIVerify and the WR QPF Verification web pages available through AWIPS. As shown in Figure 4, this began as a “significant precipitation event” over our CWA 06-12Z 4 January and ended 00-06Z 5 January. Comparison with corresponding office forecasts from 12Z 3 January indicates that the projected start of this significant event was a bit too soon, and the forecasted termination a bit too late, but that our forecasts were basically on-target with the general timing of the focus of the heaviest rain (12Z 4 January to 00Z 5 January).

Even at much longer lead times, office PoP and QPF forecasts generally verified well. The 156-hr forecast PoP grid for the 12-hr central period of this event (12Z 4 January – 00Z 5 January) is shown in Figure 5 (left panel). This contains 60% (“likely”) PoPs across the entire CWA, except where tapered down near the boundaries of our forecast district, likely resulting from an effort to maintain consistency with the lower PoPs of our neighbors. As the event

approached, PoPs were ultimately raised to 100% across the CWA, as indicated by the 60-hr forecast PoP grid for this same 12-hr period shown in Figure 5 (right panel).\*

The evolution of the WFO Monterey 12-hr PoP forecasts for 12Z 4 January to 00Z 5 January is shown in Figure 6. Consistent with the above, this shows PoP forecasts for all QPE categories raised to the likely range at hr 156, and then to categorical at hr 96. Examination of the PoP vs. QPE table for this period shows measurable precipitation having occurred over 99.8% of our CWA, with QPE of 2.00 inches or more for a bit more than 1000 of our 4772 land surface grid points.

QPF forecast evolution for this same 12-hr period, as obtained through use of BOIVerify, is shown in Figure 7 – along with the corresponding QPE (observed precipitation) grid. Our QPF forecasts projected this would be a significant precipitation event even 84 hours in advance, though amounts in the southern part of our CWA were lowered at hours 60 and 72 before being raised again as the event approached. It should also be noted that, even in the short term, the highest amounts were under-forecast. There does appear to be some question, though, about the accuracy of the observed precipitation grids, given uniform areas across some of the hills of exactly 5.0 inches (or perhaps this reflects some “bug” in either BOIVerify or the RFC QPE grids that limits the maximum 12-hr QPE to 5 inches).

### **III. SUMMARY AND DISCUSSION**

In general, the WFO Monterey QPF and especially PoP forecasts for the high-impact storm event of 4 January 2008 verified extremely well, especially for the PoPs at remarkably long lead times. At least in significant part, this appears to be a consequence of the extraordinary consistency and accuracy of the model solutions (both GFS and ECMWF), beginning well out in the extended period. The GFS 500 mb analysis for 12Z 4 January 2008 is shown in Figure 8, along with the corresponding 72-hr and 162-hr GFS forecasts. Thus even 7 days in advance, the GFS projected an anomalously strong 500 mb trough and associated PVA would then be approaching the California coast, with subsequent model runs remaining strikingly consistent in terms of both magnitude and timing.

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\* As an aside: do not believe it is unreasonable to “assign” a single PoP value to much or all of the CWA in either of the following circumstances. (1) It’s a longer-range (day 4-7) forecast and long-range (ensemble) model guidance indicates a very non-climatological storm track consistent with essentially uniform precipitation probabilities across the CWA (as in this extreme case where long-range model guidance showed a storm track displaced far southward of its climatological mean location and centered on the WFO MTR CWA plus MOS guidance PoP values themselves being approximately uniform across the area of the CWA. This was the situation corresponding to Figure 5 – left panel below. (2) It’s a shorter-range forecast in which precipitation appears definite everywhere (situation corresponding to Figure 5 – right panel below).

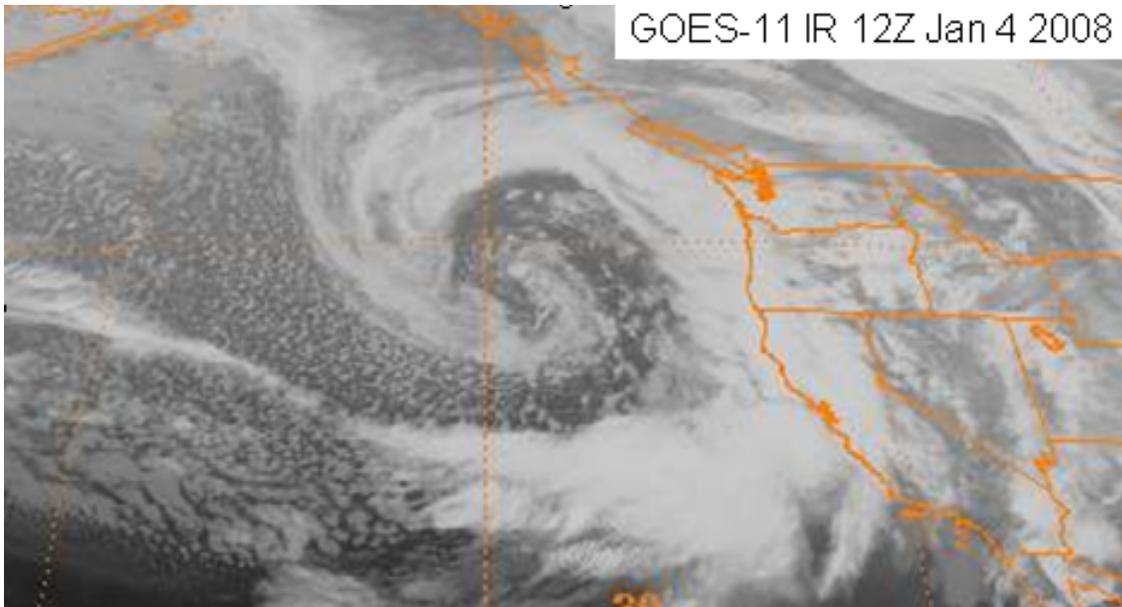


Figure 1. GOES IR Satellite image for 12Z 4 January 2008.

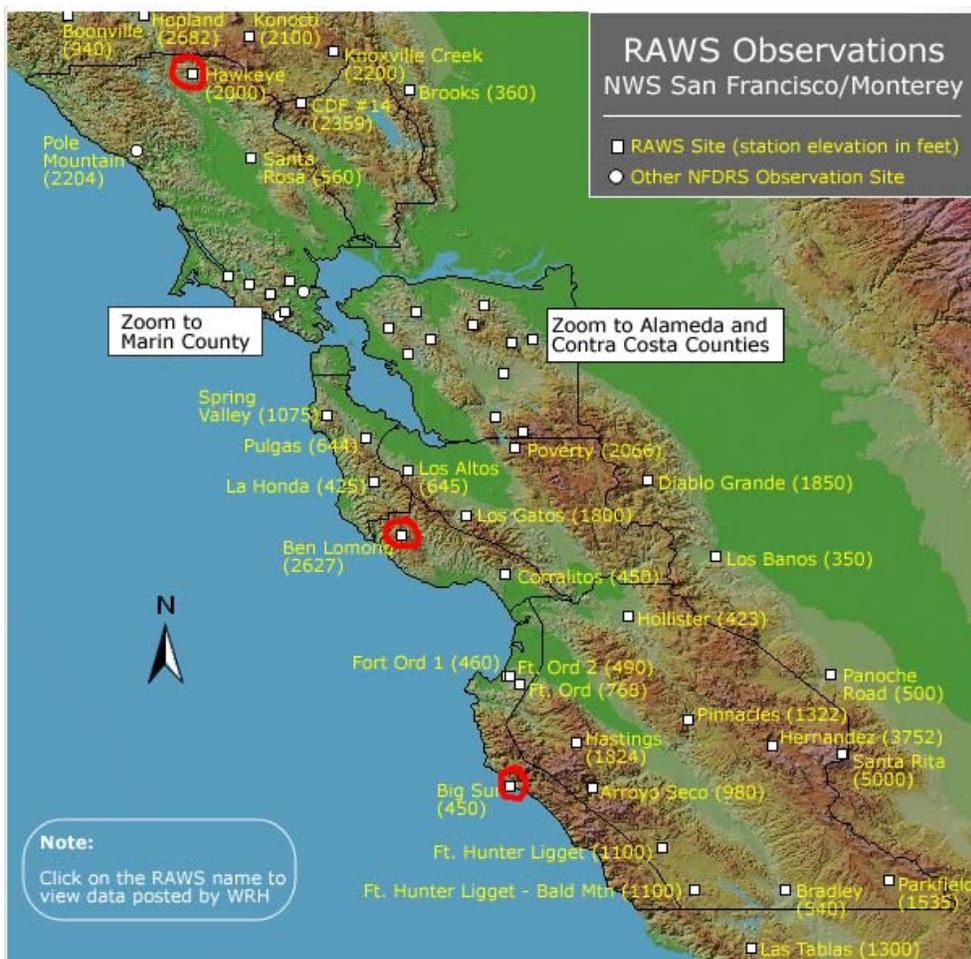


Figure 2. RAWS site locations in and adjacent to the CWA of WFO Monterey. Locations referenced in Figure 3 are circled in red.

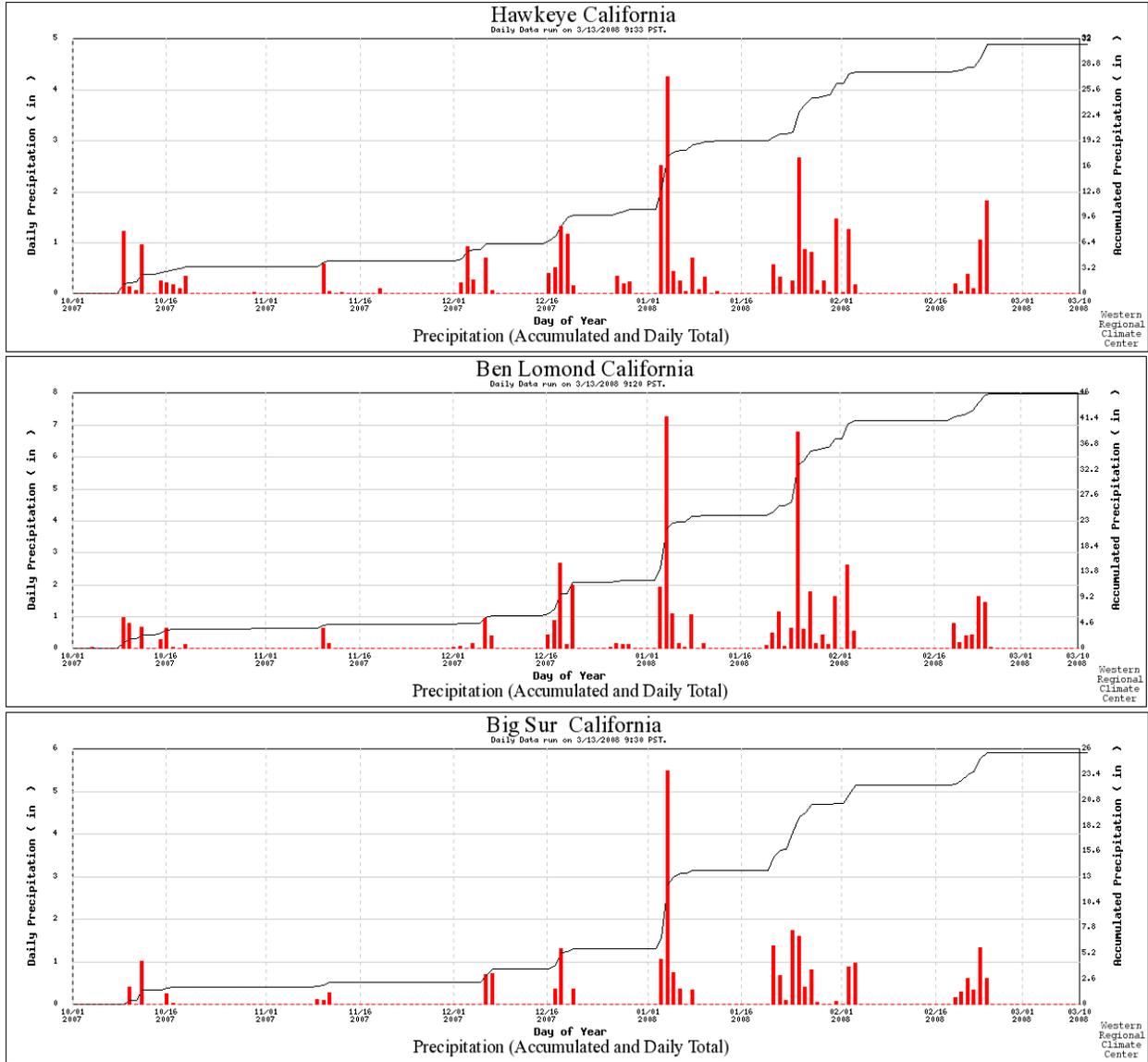


Figure 3. Daily total and accumulated precipitation for the period 1 October 2007 to 10 March 2008. Top panel: Hawkeye RAWS; Middle panel: Ben Lomond RAWS; Bottom panel: Big Sur RAWS. Locations of these 3 RAWS sites shown in Fig. 2.

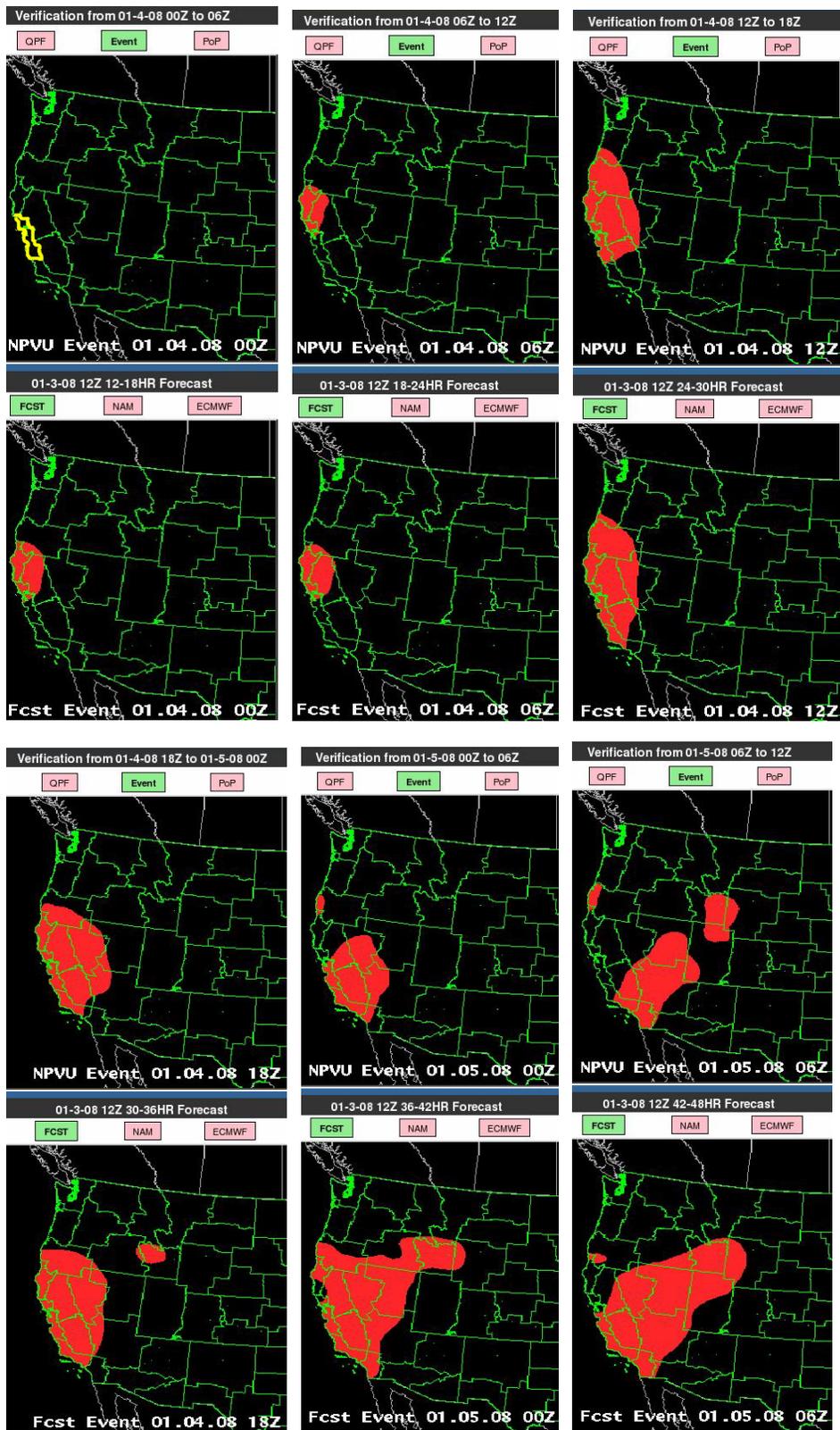


Figure 4. 4 January 2008 precipitation “event verification” (top half of each panel) vs. WFO Monterey office forecasts from 12Z 3 January.

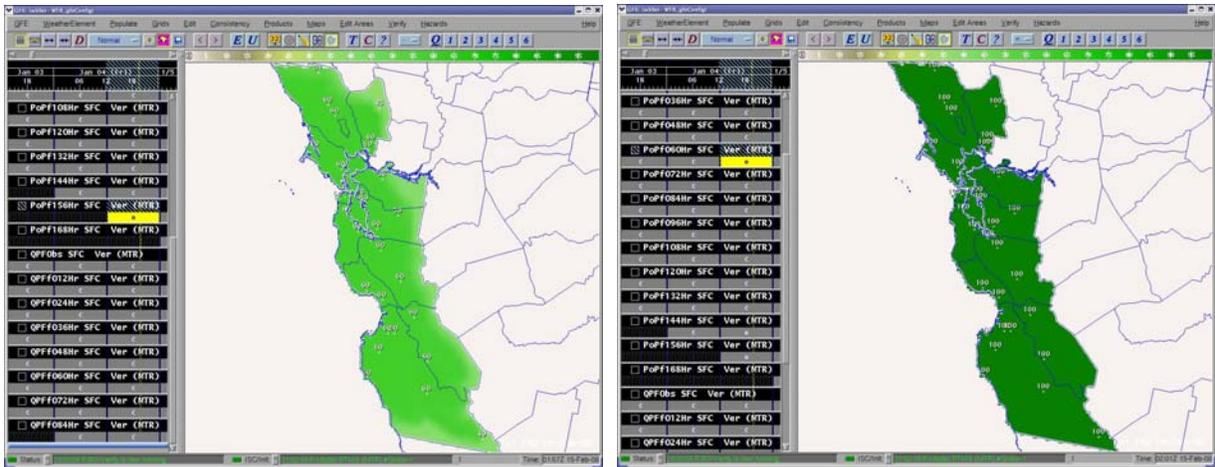


Figure 5. Left panel: 156-hr PoP forecast for the 12-hr period 12Z 4 January – 00Z 5 January. Right panel: 60-hr PoP forecast for the same 12-hr period.

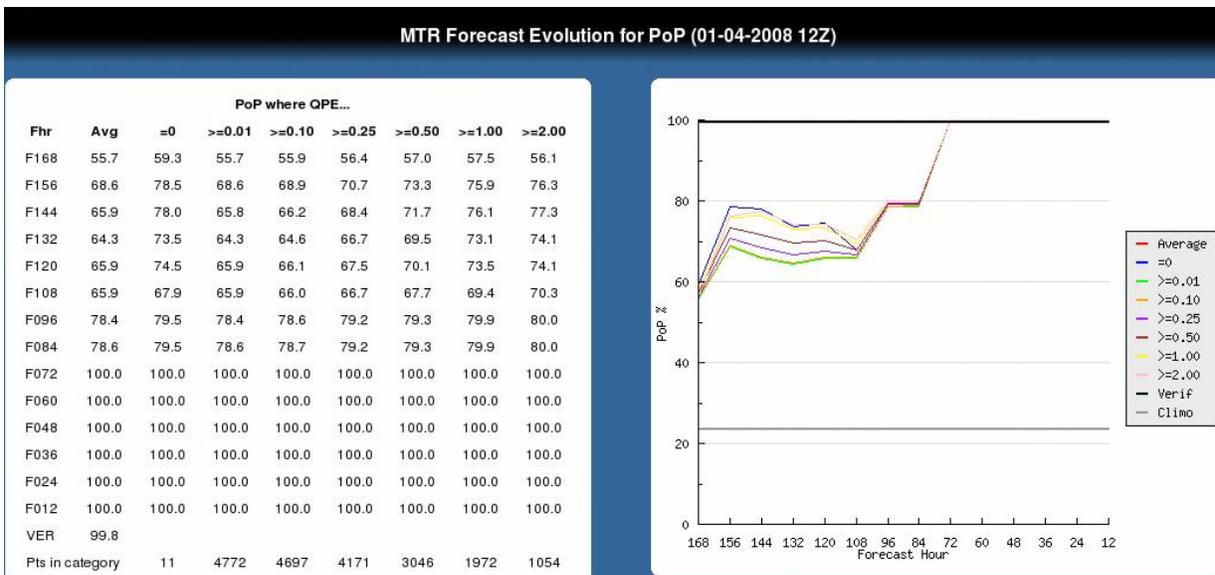


Figure 6. Evolution of WFO MTR PoP forecasts for the 12-hr period 12Z 4 January – 00Z 5 January.

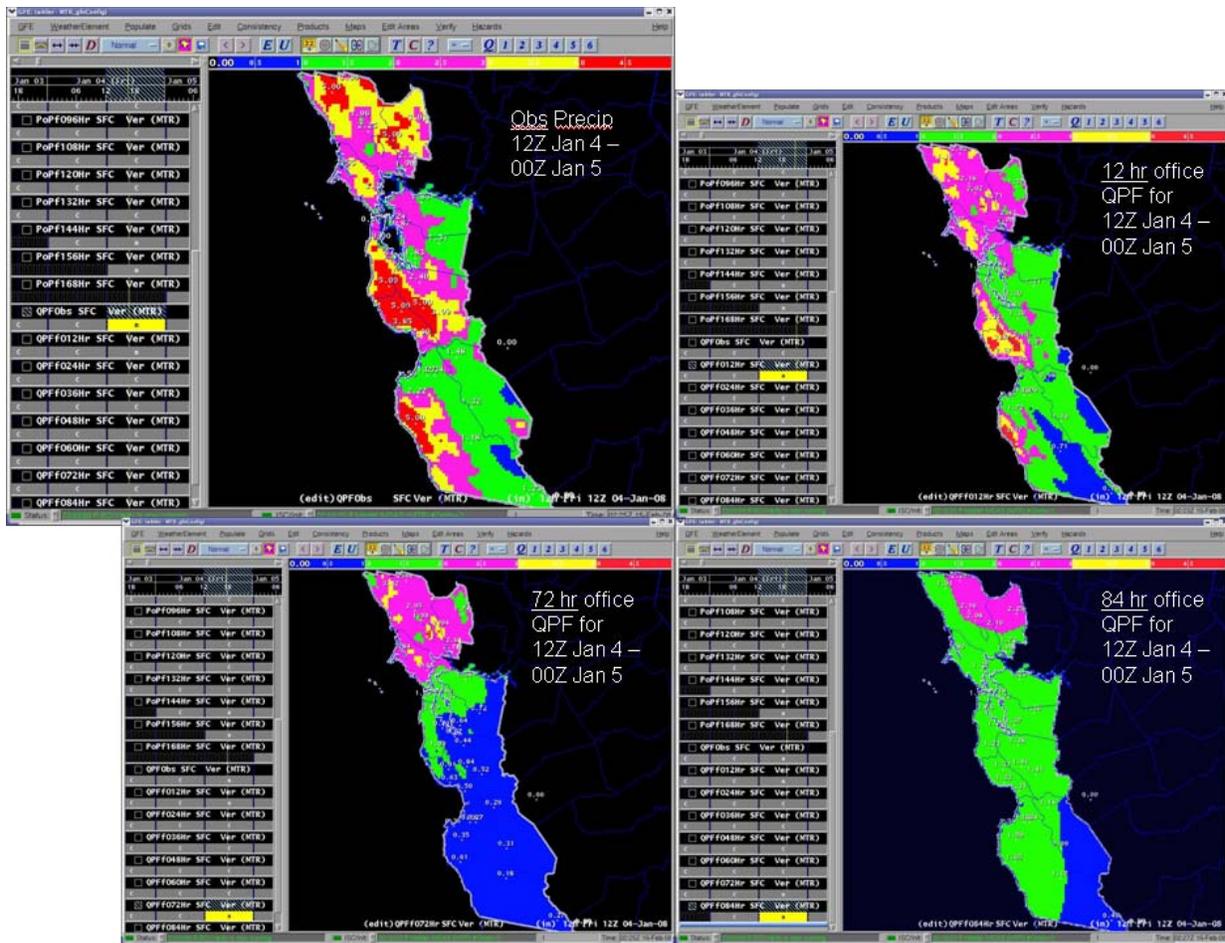


Figure 7. Upper-left panel: QPE for WFO Monterey CWA for the 12-hr period 12Z 4 January – 00Z 5 January. Upper-right panel: WFO Monterey 12-hr QPF for 12Z 4 January – 00Z 5 January. Lower-left panel: same as upper-right panel except 72-hr forecast. Lower-right panel: same as upper-right panel except 84-hr forecast.

